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Abstract of paper proposed for submission to the 3rd Applied Human Factors and Ergonomics (AHFE) International Conference 2010 to be held in Miami, FL, July 17 - 21, 2010

Title: Control of risks through the use of procedures: a method for evaluating the change in risk

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This paper considers how procedures can be used to control risks faced by an organization and proposes a means of recognizing if a particular procedure reduces risk or contributes to the organization's exposure. The proposed method was developed out of the review of work documents and the governing procedures performed in the wake of the *Columbia* accident by NASA and the Space Shuttle prime contractor, United Space Alliance, LLC. A technique was needed to understand the rules, or procedural controls, in place at the time in the context of how important the role of each rule was.

The proposed method assesses procedural risks, the residual risk associated with a hazard after a procedure's influence is accounted for, by considering each clause of a procedure as a unique procedural control that may be beneficial or harmful. For procedural risks with consequences severe enough to threaten the survival of the organization, the method measures the characteristics of each risk on a scale that is an alternative to the traditional consequence/likelihood couple. The dual benefits of the substitute scales are that they eliminate both the need to quantify a relationship between different consequence types and the need for the extensive history a probabilistic risk assessment would require.

Control Value is used as an analog for the consequence, where the value of a rule is based on how well the control reduces the severity of the consequence when operating successfully. This value is composed of two parts: the inevitability of the consequence in the absence of the control, and the opportunity to intervene before the consequence is realized. High value controls will be ones where there is minimal need for intervention but maximum opportunity to actively prevent the outcome.

Failure Likelihood is used as the substitute for the conventional likelihood of the outcome. For procedural controls, a failure is considered to be any non-malicious violation of the rule, whether intended or not. The model used for describing the Failure Likelihood considers how well a task was established by evaluating that task on five components. The components selected to define a well established task are: that it be defined, assigned to someone capable, that they be trained appropriately, that the actions be organized to enable proper completion and that some form of independent monitoring be performed.

Validation of the method was based on the information provided by a group of experts in Space Shuttle ground processing when they were presented with 5 scenarios that identified a clause from a procedure. For each scenario, they recorded their perception of how important the associated rule was and how likely it was to fail. They then rated the components of Control Value and Failure Likelihood for all the scenarios. The order in which each reviewer ranked the scenarios Control Value and Failure Likelihood was compared to the order in which they ranked the scenarios for each of the associated components; inevitability and opportunity for Control Value and definition, assignment, training, organization and monitoring for Failure Likelihood. This order comparison showed how the components contributed to a relative relationship to the substitute risk element.

With the relationship established for Space Shuttle ground processing, this method can be used to gauge if the introduction or removal of a particular rule will increase or decrease the risk associated with the hazard it is intended to control.

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